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Virtual Teaching Board

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A B S T R A C T

Surface touching has been identified as one of the factors contributing to the current COVID-19 epidemic. To prevent this kind of virus dissemination, we have developed a project called "Drawing on Air." The project's goal is to stop the COVID-19 virus from spreading by enabling non-touch interaction with surfaces. A method known as "air gesture recognition" is used to do this, enabling the user to sketch in midair and have their strokes appear on a screen. The concept might be implemented in a number of locations, including cyber cafés, businesses, and ATMs. It might potentially take the place of other touch-based interfaces, such biometrics. The following are a few advantages of the project: By stopping the virus from spreading through surface contact, it can aid in slowing the spread of COVID-19. It is a flexible and adaptive approach that may be applied in a range of contexts. Since it's a relatively new technology, there's always room for development. The following are some of the difficulties the project is facing: Accurate recognition of air gestures might be challenging due to the limitations of current technology. Since the project is still in its early phases of development, its practical implementation is still unknown.

Keywords: Object Detection, Gesture Recognition, Background Subtraction, Data Preprocessing, Real-time Processing.

Introduction

The world is changing quickly, and education is moving significantly into the digital sphere. Leading this transformation is the Virtual Teaching Board, a fantastic instrument that combines technology and instruction to enable global learning. Teachers can share lessons and interact with students online using the Virtual Teaching Board, which functions similarly to a digital whiteboard. It's more than simply text on a screen; here, educators may enhance our understanding through images, videos, and engaging activities. It is a flexible platform that allows teachers to share knowledge, interact with students, and promote teamwork in a virtual environment. Using the power of multimedia, this creative tool lets teachers communicate content using a variety of media, including text, photos, videos, and interactive simulations. The Virtual Teaching Board is fantastic, but there are still some issues that need to be resolved, such as ensuring that no one feels excluded and that everyone can utilize it. Don't panic, though; these difficulties also present an opportunity for us to improve conditions for everybody. To put it briefly, the Virtual Teaching Board is a completely new approach to learning that makes education more interesting, approachable, and customized to each student's needs. It is more than just a teaching tool. Prepare to explore, learn, and have fun as you embark on this virtual journey.

Literature Review

The goal of this project is to improve and innovate the virtual teaching board, which enables instructors to use openCV and hand gestures to explain and illustrate text and figures. The computer vision field has extensively examined the article Hand joint skeleton information-based hand gesture identification. Conventional methods have concentrated on creating efficient feature descriptors and applying machine learning algorithms. To capture the spatial-temporal motion aspects of hand gestures, the suggested model is built using a variety of feature extractors, including joint angles, geometric relationships, covariance matrix, and histogram of oriented gradients (HOG).

The study explains the architecture and optimization methods of the model as well as how deep neural networks—such as CNN, RNN, and LSTM—have been applied to enhance hand gesture detection performance. By lowering long-range dependencies, self-attention mechanisms have been used to improve the effectiveness and precision of vision-based hand gesture recognition.

While experimental graph convolutional neural networks (GCNN) have demonstrated potential in gesture detection, there are still issues with generalization and large dataset performance. These issues are resolved by the suggested Multi-branch attention-based graph and general deep learning model, which extracts various skeleton-based feature types and achieves high accuracy at cheap computational cost.

Methodology

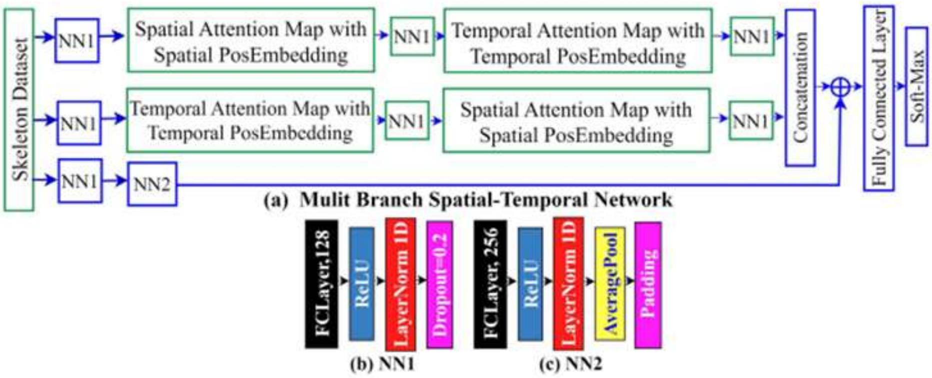


FIGURE 3. Proposed working flow architecture.

Using hand skeleton data, the researchers proposed a universal deep learning model and a multi-branch attention-based network for dynamic hand gesture identification. It used two graph-based neural network channels to create temporal-spatial features: one with a spatial attention module and a temporal attention module, and the other with the inverted sequence of the first branch.

The last branch extracted deep learning-based features using a universal deep neural network module. The final feature vector was created by concatenating the general, temporal-spatial, and spatial-temporal features and placing them in a completely linked layer. Position embedding and mask operation were used to follow the node's sequence and reduce computing cost. The proposed model was evaluated using benchmark datasets from MSRA, DHG, and SHREC'17, with accuracy rates of 12%, 92.00%, and 97.01% respectively.

When the performance of the proposed model was compared to that of existing cutting-edge methodologies, it was discovered to perform better in terms of accuracy and computation cost. The research also included related work in the field of hand gesture detection. This featured both more modern approaches that used deep learning techniques and more traditional approaches that used machine learning and the standard feature extraction method.

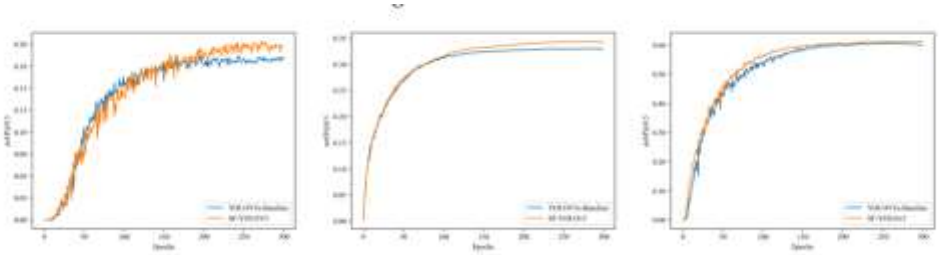
Results

State-of-art comparison of the MSRA dataset for 17 gestures.

Method Name	Class	Accuracy
LSTM	17	72.92
Green	17	79.17
Proposed Method	17	94.12

State-of-the-art comparison of the DHG dataset.

Method Name	Accuracy (%) (14 Gestures)	Accuracy (%) (28 Gestures)
JAHOG	83.85	76.53
GREN	82.29	82.03
ASJT	82.50	80.11
SoCJ+HoHD+HoWR	83.07	80.00
MARNN	84.68	80.32
CNN+RNN	85.46	74.19
NIUKF-LSTM	84.92	80.44
CNN+LSTM	85.46	74.19
MFA-Net	85.75	81.04
Res-TCN	86.90	83.60
STA-Res-TCN	89.20	85.00
Boulahia	90.48	80.48
STA-GCN	91.20	87.40
DG-STA	91.00	88.00
Proposed Method	92.00	88.78



(a) TinyPerson (b) VisDrone (c) VOC2012

Conclusion

Reviews are becoming an essential part of our daily lives; we rely on them to make the best judgments whether we're shopping, dining out, or making an online purchase. Experiments show that text data is more accurate than category data in general. Deep learning technologies are used to make objective and equitable medical recommendations. Statistical analysis is also used to increase accuracy and balance fairness by adjusting the threshold value. The accuracy of forecasts and suggestions was analyzed to assess the recommender system's performance. In the future, we will endeavor to improve our algorithm to make it more accurate while still respecting user privacy. Furthermore, various medical experts diagnose illnesses differently due to variances in medical experience. The suggested method predicts sickness and provides preventive actions by using voice data from patients and machine learning classifiers. The voice data is converted into text using the Google speech recognizer. Unlike traditional diagnosis, the proposed technique asks the patient to narrate his symptoms in order to ascertain the origin of the sickness and provide any required prophylactics. Experiments show that text data is more accurate than category data in general.

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